

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference WARN06/C/WO	FOR FURTHER ACTION see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. PCT/IE 99/ 00135	International filing date (day/month/year) 17/12/1999	(Earliest) Priority Date (day/month/year)
Applicant WARNER LAMBERT RESEARCH AND DEVELOPMENT...et al.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

- a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

- b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of invention is lacking** (see Box II).

4. With regard to the **title**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.

☐ as suggested by the applicant.

☐ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

☐ None of the figures.

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INTERNATIONAL SEARCH REPORT

International Application No.

IE 99/00135

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 C07C231/10

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 C07C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, CHEM ABS Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	KELVIN L. BAUMANN ET AL.: "The convergent synthesis of CI-981,..." TETRAHEDRON LETTERS., vol. 33, no. 17, 1992, pages 2283-2284, XP002143555 OXFORD GB cited in the application the whole document	1-5
Y	EUGEN MÜLLER: "Methoden der organischen Chemie, vol I/2, pages 383-384" 1959, GEORG THIEME VERLAG, STUTTGART XP002143556 page 383 -page 384 --- -/--	1-5

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

26 July 2000

Date of mailing of the international search report

11/08/2000

Name and mailing address of the ISA

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Rufet, J

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INTERNATIONAL SEARCH REPORT

International Application No

IE 99/00135

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5 155 251 A (BUTLER DONALD E ET AL) 13 October 1992 (1992-10-13) cited in the application example 4 ---	1-5
Y	EP 0 330 172 A (WARNER LAMBERT CO) 30 August 1989 (1989-08-30) page 29 -page 30; example 2 & US 5 097 045 A 17 March 1992 (1992-03-17) cited in the application ---	1-5
A	MACQUARRIE D J ET AL: "Catalysis of the Knoevenagel reaction by gamma-aminopropylsilica" REACTIVE & FUNCTIONAL POLYMERS,NL,ELSEVIER SCIENCE PUBLISHERS BV, vol. 35, no. 3, 1 December 1997 (1997-12-01), pages 153-158, XP004099398 ISSN: 1381-5148 the whole document -----	1

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

IE 99/00135

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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		CA 2116973 A	15-04-1993
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/IE 99/00135

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0330172 A		US 5216174 A	01-06-1993
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XP-002143555

P.D. 1992
 p. 2283/2284 (2)

The Convergent Synthesis of CI-981, an Optically Active, Highly Potent, Tissue Selective Inhibitor of HMG-CoA Reductase

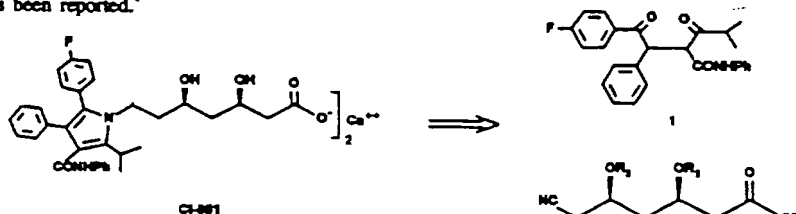
Kelvin L. Baumann, Donald E. Butler, Carl F. Deering,
 Kenneth E. Mennen, Alan Millar¹, Thomas N. Nanninga,
 Charles W. Palmer and Bruce D. Roth¹

Parke-Davis Pharmaceutical Research Division,
 Warner Lambert Company
 Chemical Development Department, Holland, Michigan 49424
¹Chemistry Department, Ann Arbor, Michigan 48105

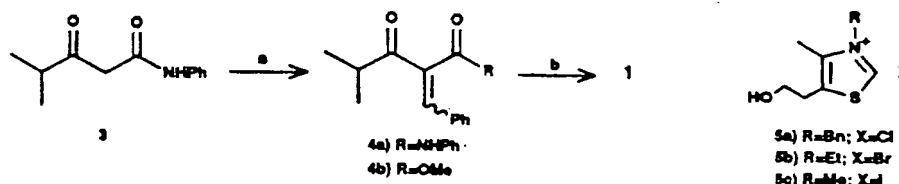
Abstract: The synthesis of CI-981 is described starting from isobutyrylacetanilide (3) and the key chiral intermediate 2.

CI-981, a potent and tissue selective inhibitor of HMG-CoA Reductase, is currently undergoing clinical trials and could prove to be an important addition to therapy for the treatment of hypocholesterolemia and the prevention of atherosclerosis.^{1,2}

Economical, large scale syntheses of enantiomerically pure compounds as complex as CI-981 require, if possible, a convergent route.³ A convergent synthesis of CI-981 required the preparation of two key intermediates; (1) and (2). However, a Paal-Knorr synthesis of such a complex pyrrole was by no means assured. The preparation of the 7-carbon side-chain acid derivative (2) has been reported.¹



Diketone 1 was prepared in two steps from commercially available isobutyrylacetanilide (3). The addition of p-fluorobenzaldehyde to the Knoevenagel product 4a was carried out using the Stetter reaction.⁴ The choice of catalyst (5) proved to be the key to the success of this reaction.

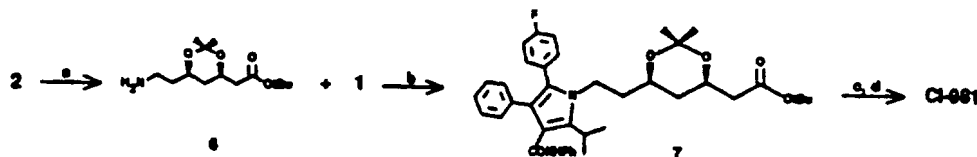


a. β -Alanine, AcOH, Hexane, Δ (85%); b. 5b, EtOH, Δ , then 4a, 4-F-C₆H₄CHO, NEt₃, Δ (80%)

Benzyl thiazolium catalyst (5a), which worked very well in the reaction of p-fluorobenzaldehyde with the methyl ester (4b),^{2a} gave the benzoin condensation product of p-fluorobenzaldehyde as the major product when used in the reaction with 4a.⁵ However, use of either the ethyl (5b) or methyl thiazolium catalyst (5c) (20 mol. %) under anhydrous, concentrated conditions provided the diketone (1) in 80% yield.⁶ To our knowledge this is the first example of the extension of the Stetter reaction to carboxamides.

¹Current address: Glaxo Inc., Department of Synthetic Organic Chemistry,
 Chemical Development Division, Research Triangle Park, NC 27709

The preparation of the amine, (6)⁷ from the intermediate nitrile (2) was accomplished in high yield using a Molybdenum doped Raney Nickel catalyst⁸, under 50 psig hydrogen pressure, in ammonia-methanol at room temperature.

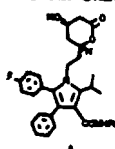


a. Pt-Ni , MeOH , 50 psig H_2 (98%); b. $(\text{CH}_3)_3\text{CO}_2\text{H}$, C_6H_6 , $\text{C}_2\text{H}_5\text{MgBr}$, $\text{C}_6\text{H}_5\text{MgBr}$, Δ (78%); c. HCl , MeOH then NaOH ; d. $\text{Ca}(\text{OAc})_2$

After extensive optimization of the Paal-Knorr pyrrole formation,⁹ conditions using a ternary solvent mixture of toluene-heptane-tetrahydrofuran (1:4:1) and pivalic acid catalysis, provided a 75% yield of 7.¹⁰ Conversion of 7 to CI-981 was carried out without isolation, by deprotection of the acetal using aqueous HCl /methanol, dilute base hydrolysis of the tert-butyl ester (anchimeric assistance) and treatment of the derived sodium salt with $\text{Ca}(\text{OAc})_2$. The hemi-calcium salt, CI-981, was isolated as an amorphous solid in an overall yield of 60% from 2, with an enantiomeric purity of $\geq 99.5\%$.^{11,12}

References:

1. Brower, P. L.; Butler, D. E.; Deering, C. F.; Le, T. V.; Millar, A.; Nanninga, T. N.; Roth, B. D., *Previous paper*.
2. a) Roth, B. D.; Blankley, C. J.; Chucholowski, A. W.; Ferguson, E.; Hoeffle, J. L.; Ortwin, D. F.; Newton, R. S.; Seizerke, C. S.; Sliskovic, D. R.; Stratton, C. D.; Wilson, M. W., *J. Med. Chem.*, 1991, 34, 357; b) Bocan, T. M. A.; Ferguson, E.; Shaw, M. K.; BakMuelker, S.; Uhlendorf, P. D.; Roth, B. D.; Sliskovic, D. R.; Newton, R. S., *Abstracts of the Xth International Symposium on Drugs Affecting Lipid Metabolism*; Houston TX, Nov 8-11, 1989, p 55. c) Shaw, M. K.; Newton, R. S.; Sliskovic, D. R.; Roth, B. D.; Ferguson, E.; Krause, B. R., *Biochem. Biophys. Res. Comm.*, 1990, 170, 726.
3. For alternative approaches to the synthesis of CI-981 see reference 2a and U.S. Patent 5,003,080.
4. Stetter, H., *Angew. Chem. Int. Ed. Engl.*, 1976, 15, 639; Stetter, H. and Kuhlmann, H., *Org. React.*, 1991, 40, 407.
5. It is reported that benzoin formation is a fast reversible reaction that precedes addition and that use of the appropriate benzoin in place of the aldehyde provides the same product. In our experience, when using p-fluorobenzaldehyde, the use of (5a) as the catalyst provided excellent conversion to the benzoin which, even under forcing conditions, could not be converted, in acceptable yield, to the required diketone (1). However use of the N-alkyl thiazolium catalysts (5b or c) provided excellent conversion to 1, with very little benzoin formation observed (HPLC). Notably, when using 5b or c, benzoin formation is dramatically increased by dilution of the reaction mixture.
6. ¹H NMR spectrum of 1 (200 MHz, in CDCl_3) δ 1.03 (d, 3H), 1.22 (d, 3H), 2.98 (quin., 1H), 4.91 (d, $J=11$ Hz, 1H), 5.51 (d, $J=11$ Hz, 1H), 6.98 - 7.43 (m, 12H), 8.17 (dd, 2H), 9.41 (br s, 1H); m.p. 208-209.5 °C. Elemental analysis and FTIR were in accord with structure.
7. ¹H NMR spectrum of 6 (200 MHz, in CDCl_3) δ 1.0-1.2 (m, 1H), 1.22 (s, 3H), 1.31 (s, 12H), 1.35-1.45 (m, 3H), 2.15 (dd, $J=6.2$ and 15.1 Hz, 1H), 2.29 (dd, $J=7.0$ and 15.1 Hz, 1H), 2.66 (t, $J=6.6$ Hz, 2H), 3.82 (m, 1H), 4.12 (m, 1H); $[\alpha]_D^{25} +14.3^\circ$ (c=1, CHCl_3). ¹³C NMR, FTIR and Mass Spectral data were in accord with structure.
8. Available as A7000[®] from Activated Metals or 3100[®] from Grace Co.
9. Paal, C., *Ber.*, 1885, 18, 367; Knorr, L., *Ber.*, 1885, 18, 299.
10. ¹H NMR spectrum of 7 (200 MHz, in CDCl_3) δ 1.0-1.7 (m, 5H), 1.30 (s, 3H), 1.36 (s, 3H), 1.43 (s, 9H), 1.53 (d, $J=7.1$ Hz, 6H), 2.23 (dd, $J=6.3$ and 15.3 Hz, 1H), 2.39 (dd, $J=6.3$ and 15.3 Hz, 1H), 3.5-3.9 (m, 3H), 4.0-4.2 (m, 2H), 6.8-7.3 (m, 14H); $[\alpha]_D^{25} +4.71^\circ$ (c=1, CHCl_3). ¹³C NMR data was in accord with structure.
11. ¹H NMR spectrum of CI-981 (200 MHz, in CDCl_3) δ 1.26 (m, 2H), 1.37 (m, 6H), 1.59 (m, 2H), 2.04 (m, 2H), 3.24-3.96 (m, 5H), 4.80 (brs, 1H), 5.75 (brs, 1H), 7.00-7.22 (m, 12H), 7.52 (d, 2H), 9.82 (s, 1H); $[\alpha]_D^{25} -7.4^\circ$ (c=1, DMSO). Elemental analysis, ¹³C NMR, FTIR and Mass Spectral data were in accord with structure.
12. The enantiomers of CI-981 have not been resolved by chiral HPLC. Conversion to lactone A allows determination of enantiomeric purity, by HPLC at 254 nm using a 25 cm Chiralcel OF column, with a mobile phase of hexane-IPA (82:18) at a flow rate of 1 ml/min.



¹H NMR spectrum of A (200 MHz, in CDCl_3) δ 1.37 (s, 3H), 1.40 (s, 3H), 1.5-1.8 (m, 4H), 2.25-2.66 (m, 2H), 3.24 (m, 1H), 3.9-4.1 (m, 3H), 4.49 (m, 1H), 5.18 (d, $J=3.1$ Hz, 1H), 6.9-7.4 (m, 12H), 7.52 (d, $J=7.8$ Hz, 2H), 9.82 (s, 1H); m.p. 159.2-160.7 °C; $[\alpha]_D^{25} +26.05^\circ$ (c=1, CHCl_3). Elemental analysis, ¹³C NMR, and FTIR data were in accord with structure.

(Received in USA 2 January 1992)

B. Arbeiten unter Feuchtigkeitsausschluß

Da es beim Arbeiten mit feuchtigkeitsempfindlichen Substanzen im wesentlichen ebenso darauf ankommt, eine Komponente der atmosphärischen Luft, nämlich die Feuchtigkeit, auszuschließen, können wir hinsichtlich der allgemeinen und speziellen Arbeitsmethoden auf die vorstehenden Abschnitte dieses Kapitels verweisen. Im folgenden seien noch einige über das bereits Gesagte hinausgehende Bemerkungen gemacht.

Man arbeitet in den eigens dafür bestimmten und schon beschriebenen Geräten im *Vakuum* oder unter einem *Inertgas*, wie Stickstoff, Kohlendioxyd usw. oder in diesem Fall auch getrockneter Luft. Ist man im Besitze der in Abb. 1 (S. 327) gezeigten Stickstoffreinigungsanlage, so wird man zweckmäßigerweise als Intergas *Stickstoff* verwenden. Auf das Aufheizen des Turmes D kann verzichtet werden, sofern der noch im Stickstoff enthaltene Sauerstoff gegenüber den Reaktionspartnern indifferent ist.

Bei einer Verwendung von *atmosphärischer Luft* muß diese mit einem der gebräuchlichen Mittel getrocknet werden¹, bevor sie der Verteilerleitung (Abb. 2, S. 328) zugeführt wird. Man trocknet z. B. mit konz. Schwefelsäure, Calciumchlorid, Magnesiumperchlorat, Phosphorpentoxyd oder Kieselgel (Blaugel). Die Trockenwirkung dieser Mittel ist naturgemäß begrenzt. Die behandelten Gase enthalten noch die in Tab. 1 angegebenen Mengen Wasser.

Die *Strömungsgeschwindigkeit* des zu trocknenden Gases muß im richtigen Verhältnis zu der *Menge des Trockenmittels* stehen. Dieses soll so angewendet werden, daß es mit dem Gas in eine möglichst innige Berührung kommt. Feste Trockenmittel sind daher immer so anzuordnen, daß sich keine Kanäle ausbilden können.

Tab. 1. Trockenmittel für Gase und Wassergehalt der damit getrockneten Gase¹

Trockenmittel	mg Wasser/l	Wasserdampf- partialdruck (Torr)
Zinkchlorid	0,8	—
Calciumchlorid	0,2	—
Calciumoxyd	0,2	—
Kieselgel	0,006	—
Schwefelsäure	0,003	—
Kaliumhydroxyd (geschmolzen) . .	0,002	—
Natriumhydroxyd (geschmolzen) .	0,002	—
Magnesiumperchlorat	0,0005	—
Phosphorpentoxyd	0,00002	—
Kühlung —80°	nicht meßbar	10 ⁻⁹
Kühlung —190°	nicht meßbar	10 ⁻¹⁰

¹ S. ds. Bd., Kap. Darstellung, Reinigung, Trocknung und Aufbewahrung von Gasen, S. 244; Kap. Trockenmittel, S. 869.

A. KLEMENC, Behandlung und Reindarstellung von Gasen, 2. Aufl., S. 52 ff., Springer-Verlag, Wien 1948.

C. WEYGAND, Organisch-chemische Experimentierkunst, 2. Aufl., S. 141 ff., Verlag J. A. Barth, Leipzig 1948.

G. BRAUER, Handbuch der präparativen anorganischen Chemie, S. 72 ff., Verlag Enke, Stuttgart 1954.

Die wirkungsvollste und sauberste Trocknung bildet die Tiefkühlung, bei der das Gas durch eine in flüssige Luft oder Kohlendioxyd/Aceton-Mischung getauchte Spirale geleitet wird.

Zum *Trocknen der Glasgeräte* genügt es für viele Zwecke, diese vor dem Gebrauch im Trockenschrank zu erhitzen, worauf man sie entweder noch vor dem völligen Abkühlen zusammensetzt oder im Exsiccator erkalten läßt. Das beliebte Spülen mit Alkohohl, Aceton oder Äther und anschließendes Trockenblasen mit Druckluft genügt im allgemeinen nicht. Größere Apparaturen werden erst nach dem Zusammensetzen durch vorsichtiges Fächeln mit der leuchtenden Flamme, Durchleiten von trockenen Gasen und Evakuieren getrocknet.

In extremen Fällen benützt man völlig verschmolzene oder mindestens vakuumdichte Apparaturen, die man unter Vorschalten von Phosphorpentoxydrohren oder einer Gasfalle mehrere Stunden auf hohes *Vakuum* auspumpt. Das Verschwinden der letzten Feuchtigkeit ist an der Güte des erreichten haltbaren Vakuums zu erkennen, z. B. am Nichtmehrauftreten des apfelgrünen Fluoreszenzlichtes bei der Annäherung eines Hochfrequenzapparates¹. Unter Umständen sind hierfür Tage notwendig.

In vielen Fällen führt auch das Trocknen des Gerätes mit einer *Metallketylösung* zum Ziel (vgl. S. 338, 375 u. 379).

Bei zusammengesetzten Apparaturen unter Verwendung von *Kühlern* achte man darauf, daß insbesondere bei feuchtem Wetter sich außen am Kühler ein Wasserbeschlag bilden kann, der evtl. beim Öffnen in das Reaktionsgefäß fließt. Dies vermeidet man am besten durch Verwendung von Kühlern mit *Innenkühlung*, also z. B. Dimroth-Kühlern².

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 C. WEYGAND, Organisch-chemische Experimentierkunst, 2. Aufl., Verlag J. A. Barth, Leipzig 1948.
 G. BRAUER, Handbuch der präparativen anorganischen Chemie, 1. Aufl., Verlag Enke, Stuttgart 1954.

¹ S. ds. Bd., Kap. Erzeugung von Vakuum und Arbeiten mit Unterdruck, S. 585.

² S. ds. Bd., Kap. Heizen und Kühlen, Messen, Registrieren und Regeln von Temperaturen, S. 662
 Vgl. ds. Handb., Bd. I/1, Kap. Destillieren und Rektifizieren, S. 805 ff.

PCT COOPERATION TREATY

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Commissioner
US Department of Commerce
United States Patent and Trademark
Office, PCT
2011 South Clark Place Room
CP2/5C24
Arlington, VA 22202
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 14 December 2000 (14.12.00)	
International application No. PCT/IB00/00654	Applicant's or agent's file reference 34.0031
International filing date (day/month/year) 16 May 2000 (16.05.00)	Priority date (day/month/year) 19 May 1999 (19.05.99)
Applicant MOLDOVEANU, Nicolae	

1. The designated Office is hereby notified of its election made:



in the demand filed with the International Preliminary Examining Authority on:

09 November 2000 (09.11.00)



in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was

was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	Authorized officer Olivia TEFY Telephone No.: (41-22) 338.83.38
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PCT COOPERATION TREA

PCT

NOTIFICATION OF THE RECORDING
OF A CHANGE(PCT Rule 92bis.1 and
Administrative Instructions, Section 422)

From the INTERNATIONAL BUREAU

To:

STOOLE, Brian, D.
Geco-Prakla (UK) Limited
Schlumberger House
Buckingham Gate
Gatwick
West Sussex RH6 0NZ
ROYAUME-UNIDate of mailing (day/month/year)
06 juillet 2001 (06.07.01)Applicant's or agent's file reference
34.0031International application No.
PCT/IB00/00654

IMPORTANT NOTIFICATION

International filing date (day/month/year)
16 mai 2000 (16.05.00)

1. The following indications appeared on record concerning:

☒ the applicant ☐ the inventor ☐ the agent ☐ the common representative

Name and Address

SCHLUMBERGER TECHNOLOGY CORPORATION
1325 South Dairy Ashford
Sugar Land, TX 77077
United States of America

State of Nationality

US

State of Residence

US

Telephone No.

Facsimile No.

Teleprinter No.

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

☒ the person ☒ the name ☒ the address ☒ the nationality ☒ the residence

Name and Address

SCHLUMBERGER HOLDINGS LIMITED
P.O. Box 71
Craigmur Chambers
Road Town
Tortola
Virgin Islands, British

State of Nationality

**

State of Residence

**

Telephone No.

Facsimile No.

Teleprinter No.

3. Further observations, if necessary:

4. A copy of this notification has been sent to:

☒ the receiving Office ☐ the designated Offices concerned
☐ the International Searching Authority ☒ the elected Offices concerned
☐ the International Preliminary Examining Authority ☐ other:The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Authorized officer

Dominique DELMAS

Facsimile No.: (41-22) 740.14.35

Telephone No.: (41-22) 338.83.38

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PATENT COOPERATION TREATY

From the

INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

STOOLE, Brian D.
GECO-PRAKLA (UK) Limited
Schlumberger House
Buckingham Gate
Gatwick, West Sussex RH6 0NZ
GRANDE BRETAGNE

Ace

4 MAY 2001 396

PCT

NOTIFICATION OF TRANSMITTAL OF
THE INTERNATIONAL PRELIMINARY
EXAMINATION REPORT

(PCT Rule 71.1)

Date of mailing
(day/month/year)

02.05.2001

Applicant's or agent's file reference
34.0031

IMPORTANT NOTIFICATION

International application No.
PCT/IB00/00654

International filing date (day/month/year)
16/05/2000

Priority date (day/month/year)
19/05/1999

Applicant

SCHLUMBERGER CANADA LIMITED

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. REMINDER

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

Name and mailing address of the IPEA/



European Patent Office - P.B. 5818 Patentlaan 2
NL-2280 HV Rijswijk - Pays Bas
Tel. +31 70 340 - 2040 Tx: 31 651 epo nl
Fax: +31 70 340 - 3016

Authorized officer

Dekker, M

Tel.+31 70 340-4046



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PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 34.0031	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/IB00/00654	International filing date (<i>day/month/year</i>) 16/05/2000	Priority date (<i>day/month/year</i>) 19/05/1999
International Patent Classification (IPC) or national classification and IPC G01V1/00		
Applicant SCHLUMBERGER CANADA LIMITED		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.



2. This REPORT consists of a total of 5 sheets, including this cover sheet.

- ☐ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☒ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand 09/11/2000	Date of completion of this report 02.05.2001
Name and mailing address of the international preliminary examining authority:  European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016	Authorized officer De Bekker, R Telephone No. +31 70 340 4094 

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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/IB00/00654

I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

Description, pages:

1-14 as originally filed

Claims, No.:

1-9 as originally filed

Drawings, sheets:

1/5-5/5 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:

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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/IB00/00654

☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	2,3,5,8
	No:	Claims	1,4,6,7,9
Inventive step (IS)	Yes:	Claims	
	No:	Claims	1-9
Industrial applicability (IA)	Yes:	Claims	1-9
	No:	Claims	

2. Citations and explanations
see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:
see separate sheet

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Reference is made to the following documents:

- US-A-4 914 636 (GARROTTA ROBERT J) 3 April 1990 (1990-04-03)
- FR-A-2 338 499 (BARBIER MAURICE) 12 August 1977 (1977-08-12)
- WO 97 18488 A (MOBIL OIL CORP) 22 May 1997 (1997-05-22)
- US-A-4 823 326 (WARD ROGER M) 18 April 1989 (1989-04-18)
- US-A-5 850 622 (VASSILIOU ANTHONY A ET AL) 15 December 1998 (1998-12-15)
- US-A-5 703 833 (ALLEN KENNETH PAUL) 30 December 1997 (1997-12-30) cited in the application
- US-A-3 885 225 (ANSTEY NIGEL A ET AL) 20 May 1975 (1975-05-20)

Part V:

Claim 1:

The US'636 is regarded as representing the closest prior art to the claimed invention (FR'499 and WO'488 can be considered equally relevant), it discloses all the features of claim 1 (see eg. abstract, col.2, ln.28-col.4, ln.33), in particular it discloses a method of seismic surveying using a plurality of vibratory seismic sources including the steps of deploying an array of vibration receivers; deploying a plurality of vibration sources; simultaneously actuating said sources (col.4, ln.30-33); acquiring data; redeploying the seismic sources so that at least one of them is positioned at a source point previously occupied by another of them (Fig.2c, 'trace displacement increment of claim 1); acquiring data attributable to said redeployed seismic sources, decomposing said data into components attributable to each said seismic source; stacking together components at a common source point (claim 19: combining by summing or weighted summing the high-frequency and low-frequency data).

Claim 1 does not therefore fulfil the novelty requirements of Art.33(2) PCT.

Claims 2,3,5,8:

These dependent claims which contain the method features concerning the amount of times that the seismic sources are to be actuated on each source point or the step of noise attenuating of the frequency components or the inversion of the seismic data using theoretical or optimal seismic source output or the selection of specific frequency

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ranges for the sources to prevent interference by harmonics are considered by the examiner as normal options for the skilled man working in the field of seismic data acquisition and processing. Examples for these method features can be found disclosed by US'326 (abstract, col.6, ln.59-63, col.9, ln.27-28), US'622 (abstract, Fig.4), US'833 (abstract, Fig.2) and US'225 (abstract, col.6, ln.5-23 and table) respectively. Claims 2,3,5,8 do not therefore meet the requirements of inventive step of Art.33(3) PCT.

Claims 4,6,7,9:

These dependent claims containing the method features concerning the recording and processing of the acquired data (4), the selection of specific non-overlapping frequency ranges for the sources to prevent interference (6), the use of overlapping sweep tapers (7) and the shifting of the sources in the redeployment step one source point in a common direction (9) are considered to be fully anticipated by US'636.

Claims 4,6,7,9 do not therefore fulfil the novelty requirements of Art.33(2) PCT.

Part VII:

Certain defects in the international application:

A discussion of US'636 and FR'499 or WO'488 should have been introduced into the description as required by Rule 5.1 (a)(ii) PCT.

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PATENT COOPERATION TREATY

PCT

NOTIFICATION OF THE RECORDING
OF A CHANGE(PCT Rule 92bis.1 and
Administrative Instructions, Section 422)

From the INTERNATIONAL BUREAU

To:

PA
Progress
IndexAbstract
Bibliogr
Renewal

STOOLE, Brian, D.

Geco-Prakla (UK) Limited

Schlumberger House

Buckingham Gate

Gatwick

West Sussex RH6 0NZ

ROYAUME-UNI

18 JUL 2001 752

Age

MIS

Date of mailing (day/month/year)

06 July 2001 (06.07.01)

Applicant's or agent's file reference

34.0031

International application No.

PCT/IB00/00654

IMPORTANT NOTIFICATION

International filing date (day/month/year)

16 May 2000 (16.05.00)

1. The following indications appeared on record concerning:



the applicant



the inventor



the agent



the common representative

Name and Address

SCHLUMBERGER TECHNOLOGY CORPORATION
1325 South Dairy Ashford
Sugar Land, TX 77077
United States of America

State of Nationality

US

State of Residence

US

Telephone No.

Facsimile No.

Teleprinter No.

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:



the person



the name



the address



the nationality



the residence

Name and Address

SCHLUMBERGER HOLDINGS LIMITED
P.O. Box 71
Craigmur Chambers
Road Town
Tortola
Virgin Islands, British

State of Nationality

**

State of Residence

**

Telephone No.

Facsimile No.

Teleprinter No.

3. Further observations, if necessary:

4. A copy of this notification has been sent to:



the receiving Office



the International Searching Authority



the International Preliminary Examining Authority



the designated Offices concerned



the elected Offices concerned



other:

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer

Dominique DELMAS

Telephone No.: (41-22) 338.83.38

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Schlumberger House
Gatwick Airport, West Sussex
RH6 0NZ England
Tel: +44 (0)1293 556655
Fax: +44 (0)1293 556947

Intellectual Property Law Department

Tel: 44 1293 556968

Fax: 44 1293 556442

15 May 2001

International Bureau of WIPO
PCT Receiving Office Section
34, chemin des Colombettes
1211 Geneva 20
Switzerland

Dear Sirs

PCT Patent Application No PCT/IB00/00654
SCHLUMBERGER TECHNOLOGY CORPORATION
Our File: 34.0031

Please note that Schlumberger Technology Corporation has assigned all its rights in the above application to Schlumberger Holdings Limited of PO Box 71, Craigmuir Chambers, Road Town, Tortola, British Virgin Islands. Accordingly, please record Schlumberger Holdings Limited as the new Applicant for all countries except Canada, France and US. The Applicants for Canada, France and US are unchanged.

We look forward to receiving a Form PCT/IB/306 in due course.

Yours faithfully
for and on behalf of Schlumberger Technology Corporation
and Schlumberger Holdings Limited

B D Stoole
Attorney-in-Fact

WIPO/Applicants

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ASSIGNMENT

We, SCHLUMBERGER TECHNOLOGY CORPORATION, being entitled to the benefit of International Patent Application No PCT/IB00/00654 (WO 00/72049), filed 16 May 1999 (hereinafter referred to as "the Application") with respect to all countries designated therein except Canada and France, do hereby assign unto SCHLUMBERGER HOLDINGS LIMITED all our right, title and interest in the Application, to the intent that any Letters Patent granted in any of the countries designated in the Application other than Canada, France and the United States of America shall be in the name of and shall vest in the said SCHLUMBERGER HOLDINGS LIMITED.

Signed at Gatwick, West Sussex, England, this 15th day of May 2001, for and on behalf of SCHLUMBERGER TECHNOLOGY CORPORATION.



B D Stoodle
Attorney-in-Fact



Witness

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REC'D 02 MAY 2001

WIPO

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)



Applicant's or agent's file reference 34.0031	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/IB00/00654	International filing date (day/month/year) 16/05/2000	Priority date (day/month/year) 19/05/1999
International Patent Classification (IPC) or national classification and IPC G01V1/00		
Applicant SCHLUMBERGER CANADA LIMITED		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 5 sheets, including this cover sheet.
- ☐ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☒ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand 09/11/2000	Date of completion of this report 02.05.2001
Name and mailing address of the international preliminary examining authority:  European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016	Authorized officer De Bekker, R Telephone No. +31 70 340 4094 

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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/IB00/00654

I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

Description, pages:

1-14 as originally filed

Claims, No.:

1-9 as originally filed

Drawings, sheets:

1/5-5/5 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:

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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/IB00/00654

☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	2,3,5,8
	No:	Claims	1,4,6,7,9
Inventive step (IS)	Yes:	Claims	
	No:	Claims	1-9
Industrial applicability (IA)	Yes:	Claims	1-9
	No:	Claims	

2. Citations and explanations
see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:
see separate sheet

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**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/IB00/00654

Reference is made to the following documents:

- US-A-4 914 636 (GARROTTA ROBERT J) 3 April 1990 (1990-04-03)
- FR-A-2 338 499 (BARBIER MAURICE) 12 August 1977 (1977-08-12)
- WO 97 18488 A (MOBIL OIL CORP) 22 May 1997 (1997-05-22)
- US-A-4 823 326 (WARD ROGER M) 18 April 1989 (1989-04-18)
- US-A-5 850 622 (VASSILIOU ANTHONY A ET AL) 15 December 1998 (1998-12-15)
- US-A-5 703 833 (ALLEN KENNETH PAUL) 30 December 1997 (1997-12-30)
cited in the application
- US-A-3 885 225 (ANSTEY NIGEL A ET AL) 20 May 1975 (1975-05-20)

Part V:

Claim 1:

The US'636 is regarded as representing the closest prior art to the claimed invention (FR'499 and WO'488 can be considered equally relevant), it discloses all the features of claim 1 (see eg. abstract, col.2, ln.28-col.4, ln.33), in particular it discloses a method of seismic surveying using a plurality of vibratory seismic sources including the steps of deploying an array of vibration receivers; deploying a plurality of vibration sources; simultaneously actuating said sources (col.4, ln.30-33); acquiring data; redeploying the seismic sources so that at least one of them is positioned at a source point previously occupied by another of them (Fig.2c, 'trace displacement increment of claim 1); acquiring data attributable to said redeployed seismic sources, decomposing said data into components attributable to each said seismic source; stacking together components at a common source point (claim 19: combining by summing or weighted summing the high-frequency and low-frequency data).

Claim 1 does not therefore fulfil the novelty requirements of Art.33(2) PCT.

Claims 2,3,5,8:

These dependent claims which contain the method features concerning the amount of times that the seismic sources are to be actuated on each source point or the step of noise attenuating of the frequency components or the inversion of the seismic data using theoretical or optimal seismic source output or the selection of specific frequency

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**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/IB00/00654

ranges for the sources to prevent interference by harmonics are considered by the examiner as normal options for the skilled man working in the field of seismic data acquisition and processing. Examples for these method features can be found disclosed by US'326 (abstract, col.6, ln.59-63, col.9, ln.27-28), US'622 (abstract, Fig.4), US'833 (abstract, Fig.2) and US'225 (abstract, col.6, ln.5-23 and table) respectively. Claims 2,3,5,8 do not therefore meet the requirements of inventive step of Art.33(3) PCT.

Claims 4,6,7,9:

These dependent claims containing the method features concerning the recording and processing of the acquired data (4), the selection of specific non-overlapping frequency ranges for the sources to prevent interference (6), the use of overlapping sweep tapers (7) and the shifting of the sources in the redeployment step one source point in a common direction (9) are considered to be fully anticipated by US'636.

Claims 4,6,7,9 do not therefore fulfil the novelty requirements of Art.33(2) PCT.

Part VII:

Certain defects in the international application:

A discussion of US'636 and FR'499 or WO'488 should have been introduced into the description as required by Rule 5.1 (a)(ii) PCT.

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INTERNATIONAL SEARCH REPORT

Patent Application No
PCT/IB 00/00654

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G01V1/00 G01V1/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G01V

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ, INSPEC, COMPENDEX

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 914 636 A (GARROTTA ROBERT J) 3 April 1990 (1990-04-03)	1,4,6,7, 9
Y	abstract; claims 1,2,8,19; figures 2-4,6,7 column 2, line 26 -column 4, line 34	2,3,5,8
Y	US 4 823 326 A (WARD ROGER M) 18 April 1989 (1989-04-18)	2
A	abstract; figures 2-5 column 4, line 8 - line 17 column 6, line 59 - line 66 column 9, line 17 - line 29	8
Y	US 5 850 622 A (VASSILIOU ANTHONY A ET AL) 15 December 1998 (1998-12-15) abstract; figure 4	3
	--- -/--	

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

- *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- *&* document member of the same patent family

Date of the actual completion of the international search

4 August 2000

Date of mailing of the international search report

11/08/2000

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

De Bekker, R

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INTERNATIONAL SEARCH REPORT

International Application No.

PCT/IB 00/00654

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5 703 833 A (ALLEN KENNETH PAUL) 30 December 1997 (1997-12-30) cited in the application	5
A	abstract; figures 1,2	3
Y	US 3 885 225 A (ANSTEY NIGEL A ET AL) 20 May 1975 (1975-05-20)	8
A	figure 5 column 6, line 11 - line 19	1,2,6
X	WO 97 18488 A (MOBIL OIL CORP) 22 May 1997 (1997-05-22) abstract; claims 1,3	1
X	FR 2 338 499 A (BARBIER MAURICE) 12 August 1977 (1977-08-12)	1,6
A	page 1, line 21 - line 38; figures 1,2 page 2, line 9 - line 20 page 2, line 35 - page 3, line 1 page 3, line 33 - line 39; claims 4,5 page 5, line 15 - line 22 page 6, line 21 - line 27 page 1, line 34 - line 38	2
A	US 4 982 374 A (EDINGTON B LEON ET AL) 1 January 1991 (1991-01-01) column 1, line 14 - line 51	1,2
A	US 4 037 190 A (MARTIN LINCOLN A) 19 July 1977 (1977-07-19) abstract column 5, line 9 - line 22	8
A	US 5 721 710 A (SALLAS JOHN J ET AL) 24 February 1998 (1998-02-24) cited in the application abstract	1

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/IB 00/00654

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 4914636	A	03-04-1990	FR 2622022 A AT 65611 T AU 2395388 A BR 8805427 A CA 1325840 A DE 3863895 D EP 0313459 A MX 171345 B	21-04-1989 15-08-1991 20-04-1989 20-06-1989 04-01-1994 29-08-1991 26-04-1989 20-10-1993
US 4823326	A	18-04-1989	NONE	
US 5850622	A	15-12-1998	CA 2242757 A EP 0873527 A NO 983130 A WO 9820367 A	14-05-1998 28-10-1998 07-09-1998 14-05-1998
US 5703833	A	30-12-1997	CA 2235411 A CN 1201530 A EP 0861450 A NO 982146 A WO 9718491 A	22-05-1997 09-12-1998 02-09-1998 13-05-1998 22-05-1997
US 3885225	A	20-05-1975	GB 1423366 A AU 5825473 A CA 984048 A	04-02-1976 23-01-1975 17-02-1976
WO 9718488	A	22-05-1997	US 5822269 A CA 2233856 A CN 1202252 A EP 0861448 A NO 982144 A	13-10-1998 22-05-1997 16-12-1998 02-09-1998 13-05-1998
FR 2338499	A	12-08-1977	NONE	
US 4982374	A	01-01-1991	DE 69008998 D DE 69008998 T EP 0425250 A	23-06-1994 01-09-1994 02-05-1991
US 4037190	A	19-07-1977	US 4058791 A US 4189704 A	15-11-1977 19-02-1980
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INTERNATIONAL COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 34.0031	FOR FURTHER ACTION see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. PCT/IB 00/ 00654	International filing date (day/month/year) 16/05/2000	(Earliest) Priority Date (day/month/year) 19/05/1999
Applicant SCHLUMBERGER CANADA LIMITED		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

- a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

- b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of Invention is lacking** (see Box II).

4. With regard to the title,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the abstract,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.

☐ as suggested by the applicant.

☒ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

2

☐ None of the figures.

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INTERNATIONAL SEARCH REPORT

International Application No.

PCT/IB 00/00654

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 G01V1/00 G01V1/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 G01V

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ, INSPEC, COMPENDEX

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 914 636 A (GARROTTA ROBERT J) 3 April 1990 (1990-04-03)	1,4,6,7, 9
Y	abstract; claims 1,2,8,19; figures 2-4,6,7 column 2, line 26 -column 4, line 34 ---	2,3,5,8
Y	US 4 823 326 A (WARD ROGER M) 18 April 1989 (1989-04-18)	2
A	abstract; figures 2-5 column 4, line 8 - line 17 column 6, line 59 - line 66 column 9, line 17 - line 29 ---	8
Y	US 5 850 622 A (VASSILIOU ANTHONY A ET AL) 15 December 1998 (1998-12-15) abstract; figure 4 --- -/--	3

☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- "&" document member of the same patent family

Date of the actual completion of the international search

4 August 2000

Date of mailing of the international search report

11/08/2000

Name and mailing address of the ISA

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De Bekker, R

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INTERNATIONAL SEARCH REPORT

International Application No
PCT/IB 00/00654

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5 703 833 A (ALLEN KENNETH PAUL) 30 December 1997 (1997-12-30) cited in the application	5
A	abstract; figures 1,2 ----	3
Y	US 3 885 225 A (ANSTEY NIGEL A ET AL) 20 May 1975 (1975-05-20)	8
A	figure 5 column 6, line 11 - line 19 ----	1,2,6
X	WO 97 18488 A (MOBIL OIL CORP) 22 May 1997 (1997-05-22) abstract; claims 1,3 ----	1
X	FR 2 338 499 A (BARBIER MAURICE) 12 August 1977 (1977-08-12)	1,6
A	page 1, line 21 - line 38; figures 1,2 page 2, line 9 - line 20 page 2, line 35 - page 3, line 1 page 3, line 33 - line 39; claims 4,5 page 5, line 15 - line 22 page 6, line 21 - line 27 page 1, line 34 - line 38 ----	2
A	US 4 982 374 A (EDINGTON B LEON ET AL) 1 January 1991 (1991-01-01) column 1, line 14 - line 51 ----	1,2
A	US 4 037 190 A (MARTIN LINCOLN A) 19 July 1977 (1977-07-19) abstract column 5, line 9 - line 22 ----	8
A	US 5 721 710 A (SALLAS JOHN J ET AL) 24 February 1998 (1998-02-24) cited in the application abstract -----	1

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

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